UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
OSB1997-0797

July, 11 1997

Mr. Dave Reilly
Federal Highway Administration
Oregon Division
The Equitable Center, Suite 100
530 Center Street NE
Salem, Oregon 97301

Re: Biological Opinion on the North Medford Interchange Project on Bear Creek, Jackson County, Medford, Oregon

Dear Mr. Reilly:

Enclosed is the National Marine Fisheries Service's (NMFS) biological opinion on the North Medford Interchange project as described in the Oregon Department of Transportation's (ODOT) South Coast Basins Programmatic Biological Assessment (BA). Due to timing constraints associated with the North Medford action, ODOT has requested that NMFS provide a biological and conference opinion separate from the other actions included in the BA. This opinion addresses southern Oregon/northern California (SONC) coho salmon, listed as threatened, and Klamath Mountain Province (KMP) steelhead, proposed threatened. This opinion constitutes formal consultation for

SONC coho salmon and a formal conference for KMP steelhead. The NMFS has determined that the subject action is not likely to jeopardize the continued existence of SONC coho salmon and KMP steelhead.

Sincerely,

William Stelle, Jr.
Regional Administrator

Enclosure

cc: P. Dykman (ODOT)
C. Sheridan (ODOT)

Endangered Species Act - Section 7
Consultation

BIOLOGICAL OPINION

North Medford Interchange
Rogue River Basin

Agency: Oregon Department of Transportation for the Federal Highway Administration

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Date Issued: July 11, 1997

Refer to: OSB1997-0797

TABLE OF CONTENTS

steelhead, chum salmon, chinook salmon, and sea-run cutthroat trout

I. Background

On February 10, 1997, NMFS received from the Oregon Department of Transportation (ODOT) a biological assessment (BA) and letter requesting formal conferencing for all proposed and on-going ODOT actions within the Rogue River Basin and South Coast Basins of Oregon. The ODOT is the designated non)Federal representative for transportation related actions in Oregon that receive funds from the Federal Highway Administration. Four species proposed for listing under the Endangered Species Act (ESA) were considered in the BA. These species are southern Oregon/northern California (SONC) coho salmon, Oregon Coast coho salmon, Klamath Mountains Province (KMP) steelhead, and Oregon Coast steelhead. Subsequent to submission of the BA, NMFS determined that Oregon Coast coho salmon did not warrant listing at this time but did list SONC coho salmon as threatened under section 4 of the ESA (62 FR 24588; May 6, 1997). Oregon Coast steelhead and KMP steelhead remain under proposed rule (61 FR 41541; August 9, 1996).

This opinion addresses the North Medford Interchange project (described in section II below) which is one of a host of actions included in the South Coast Basins Programmatic BA. Due to timing constraints associated with the North Medford action, ODOT has requested that NMFS provide a biological and conference opinion separate from the other actions included in the BA. Two of the four species addressed in the BA do occur in the proposed action area; these two species are SONC coho salmon and KMP steelhead. Therefore, this opinion constitutes formal consultation for SONC coho salmon and a formal conference for KMP steelhead.

The objective of this opinion is to determine whether the proposed North Medford Interchange project is likely to jeopardize the continued existence of SONC coho salmon (*Onchorhynchus kisutch*) and KMP steelhead (*O. mykiss*). While this opinion evaluates effects of the proposed action on Pacific salmonid habitat, critical habitat has not been proposed or designated for these species and therefore conclusions regarding destruction or adverse modification of critical habitat are not included in this opinion.

II. Proposed Action

The proposed action would occur in the interior Rogue River Valley in Jackson County near Medford, Oregon. The specific water body affected by this action is Bear Creek, a tributary to the Rogue River. This project would entail construction of a free right-turn lane from Crater Lake Highway (OR 62) to the southbound lanes of Interstate 5 (I-5) and widening the OR 62 bridge over Bear Creek. A retaining wall would be built to support the widened on-ramp for the southbound merge lane and the Bear Creek Greenway bike path. An existing wood truss bridge on an abandoned haul road would be removed and the streambank contoured to increase the flood capacity of Bear Creek in the action area. For scour protection, the entire channel under the OR 62 bridge would be reinforced with a concrete apron installed below the channel thalweg. Rocks would be randomly set in the top layer of concrete to collect and retain natural river bed material. The bridge widening, retaining wall construction and removal of the wood truss bridge would require in-water work. All work in the stream channel would be accomplished within the Oregon Department of Fish and Wildlife’s prescribed in-water work period of June 15 through September 15 and would be completed in 1997.

III. Biological Information and Critical Habitat

The listing status, biological information, and critical habitat elements for SONC coho salmon and KMP steelhead are described in Attachment 1. While critical habitat has not been designated or proposed, the attachment describes potential critical habitat elements for these ESUs.

IV. Evaluating Proposed Actions

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). Attachment 2 describes how NMFS applies the ESA jeopardy standards to consultations on Federal actions.

As described in Attachment 2, the first steps in applying the ESA jeopardy standards are to define the biological requirements of the ESU and to describe the listed species’ current status as reflected by the environmental baseline. In the next steps, NMFS’ jeopardy analysis considers how proposed actions are expected to directly and indirectly affect specific environmental factors that define properly functioning aquatic habitat essential for the survival and recovery of the species. This analysis is set within the dual context of the species’ biological requirements and the existing conditions under the environmental baseline (defined in Attachment 1). The analysis takes into consideration an overall picture of the beneficial and detrimental activities taking place within the action area. If the cumulative actions are found to jeopardize the listed species then NMFS must identify any reasonable and prudent alternatives to the proposed action.

A. Biological Requirements

For this consultation, NMFS finds that the biological requirements of the listed and proposed ESUs are best expressed in terms of environmental factors that define properly functioning freshwater aquatic habitat necessary for survival and recovery of the ESUs. Individual environmental factors include water quality, habitat access, physical habitat elements, and channel condition. Properly functioning watersheds, where all of the individual factors operate together to provide healthy aquatic ecosystems, are also necessary for the survival and recovery of the listed and proposed ESUs. This information is summarized in Attachment 1.

B. Environmental Baseline

<u>Current range-wide status of ESUs under environmental baseline.</u>

NMFS described the current population status of the SONC coho salmon ESU in its status review (Weitkamp *et al.* 1995) and in the final rule (62 FR 24588; May 6, 1997). This ESU is composed of populations between Punta Gorda (California) and Cape Blanco (Oregon). The bulk of coho salmon production in this ESU currently consists of stocks from the Rogue River, Klamath River, Trinity River, and Eel River basins. The Smith River, Mad River and Redwood Creek in California and the Elk River in Oregon are known to support smaller populations. Regular escapement data is very limited for this ESU. In the absence of adequate population data, aquatic habitat condition provides a means of evaluating the status of SONC coho salmon for the environmental baseline assessment. Attachment 1 provides further discussion regarding the current range-wide status of this ESU.

The current range-wide status of KMP steelhead is described in Busby *et al.* (1994) and is summarized in Attachment 1. This ESU occupies river basins from the Elk River in Oregon to the Klamath and Trinity Rivers in California, inclusive. As with the SONC coho salmon, population data is not adequate and therefore habitat condition is used as a means of evaluating the status of KMP steelhead for the environmental baseline assessment.

<u>Current status of listed/proposed ESUs under environmental baseline within the action area</u>

The action area is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR 402.02). The general action area can be defined as the area downstream from the project site on Bear Creek to its confluence with the Rogue River. A more specific action area is Bear Creek between stream miles 8 and 9.

Bear Creek and associated tributaries do provide spawning and rearing habitat for SONC coho salmon and KMP steelhead. While historically present, few natural spawning SONC coho salmon are found in the Bear Creek drainage today (Jerry Vogt, Biologist, Oregon Department of Fish and Wildlife, pers. comm.). KMP steelhead do spawn in tributaries of Bear Creek upstream of the action area, which functions as a migratory corridor for these species. The immediate action area is heavily urbanized and therefore channelized, sparsely vegetated, and is severely dewatered by upstream diversions during the summer months. Summer water temperatures are typically too high for salmonids, reaching as much as 80^0 in some years.

Based on the best information available on the current status of the three proposed/listed ESUs rangewide (Attachment 1) and within the action area, the information available regarding population status, population trends, and genetics (see Attachment 2), and the poor environmental baseline conditions within the action area, NMFS concludes that not all of the biological requirements of the proposed and listed ESUs within the action area are currently being met under the environmental baseline. Thus, actions that do not retard attainment of properly functioning aquatic conditions when added to the environmental baseline would not jeopardize the continued existence of anadromous salmonids (i.e. actions that permanently degrade anadromous salmonid habitat would jeopardize the continued existence of these species).

V. Analysis of Effects

A. Effects of Proposed Action

The effects determination in this opinion were made using a method for evaluating current aquatic conditions (the environmental baseline) and predicting effects of actions on them. This process is described in the document “Making ESA Determinations of Effect for Individual or Grouped Actions at the Watershed Scale” (NMFS 1996). This assessment method was designed for the purpose of providing adequate information in a tabular form for NMFS to determine the effects of actions subject to consultation. The effects of actions are expressed in terms of the expected effect (restore, maintain, or degrade) on each of approximately 12 aquatic habitat factors in the project area.

The results of the completed checklist for the proposed action provides a basis for determining the overall effects on the environmental baseline in the action area. The action covered in this opinion was shown to maintain environmental factors over the long-term (more than one year) that could potentially be affected by the proposed project (see Table 1 below). Sediment inputs to Bear Creek are likely to result from the proposed action due to in-water work, but are expected to be temporary and localized. A number of measures would be implemented to reduce sedimentation. These measures include in-water work during lowest flows and within coffer dams, staked straw bales and sediment fencing where needed, ditching and diking below cut slopes to redirect runoff, and other measures to minimize excess sediment inputs. Some vegetation would be removed that would not be replaced at the project site, but some replanting of willows and/or red alder would be completed at the site. For mitigation, plantings would occur upstream that are expected to contribute more to the function of riparian vegetation than could be accomplished in the immediate action area due to channelization and urbanization of this area.

With implementation of erosion control measures and replanting of vegetation both at the project site and upstream, it is expected that the existing environmental baseline would be maintained over the long-term. However, short-lived adverse effects such as temporary increases in sediment and heavy equipment operation in the channel have the potential to result in incidental take. NMFS expects this to be mitigated by the likely absence of listed/proposed species due to expected high water temperatures during the summer in-water work window.

Table 1. Summary checklist of environmental baseline and effects of the North Medford Interchange on relevant indicators. Short term (less than one year) impacts on relevant indicators are indicated by (-) and are not expected to alter the existing environmental baseline.

PATHWAYS: INDICATORS	ENVIRONMENTAL BASELINE: Properly[1] Functioning	At Risk[1]	Not Propr.[1] Functioning	EFFECTS OF THE ACTION(S): Restore[1]	Maintain[1]	Degrade[1]
<u>Water Quality:</u>						
Temperature			X		X	
Sediment		X			X(-)	
<u>Habitat Access:</u>						
Physical Barriers	X				X	
<u>Habitat Elements:</u>						
Substrate		X			X(-)	
Large Woody Debris			X		X	
Pool Frequency		X			X	
Pool Quality		X			X	
Off-channel Habitat		X			X	
<u>Channel Conditions:</u>						
Streambank Cond.			X		X(-)	
Floodplain Connectivity		X			X(-)	
<u>Watershed Conditions:</u>						
Disturbance History			X		X	
Riparian Reserves		X			X	

[1] These three categories of function ("properly functioning", "at risk", and "not properly functioning") and the three effects ("restore", "maintain", and "degrade") are defined for each indicator in NMFS (1996).

B. Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." For the purposes of this analysis, the action area encompasses the project site on Bear Creek downstream to its confluence with the Rogue River. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. In addition, non-Federal actions that require authorization under section 10 of the ESA will be evaluated in section 7 consultations. Therefore, these actions are not considered cumulative to the proposed action. NMFS is not aware of any future new (or changes to existing) State and private activities within the action area that would cause greater impacts to listed species than presently occurs. NMFS assumes that future private and State actions will continue at similar intensities as in recent years.

VI. Conclusion

NMFS has determined that, based on the available information, the North Medford Interchange project is not likely to jeopardize the continued existence of SONC coho salmon or KMP steelhead. NMFS used the best available scientific and commercial data to apply its jeopardy analysis (described in Attachment 2), when analyzing the effects of the proposed action on the biological requirements of the species relative to the environmental baseline (described in Attachment 1) , together with cumulative effects. NMFS applied its evaluation methodology (NMFS 1996) to the proposed action and found that it would cause minor, short-term adverse degradation of anadromous salmonid habitat due to sediment impacts, and possibly cause direct incidental take during in-water work. However, the proposed action is not expected to result in further degradation of aquatic habitat over the long term or result in substantial incidental take. High water temperatures during the summer in-water work window would likely preclude the presence of SONC coho salmon or KMP steelhead. Thus, the effects of the proposed action would not reduce prespawning survival, egg-to-smolt survival, or upstream/downstream migration survival rates to a level that would appreciably diminish the likelihood of survival and recovery of these species.

VIII. Conservation Recommendations

Section 7 (a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information. NMFS finds that the general minimization/avoidance measures and site specific measures, as described in the BA, are sufficient and therefore we do not recommend any further conservation measures at this time.

IX. Reinitiation of Consultation

Consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or, a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

X. References

Section 7(a)(2) of the ESA requires biological opinions to be based on "the best scientific and commercial data available." This section identifies the data used in developing this opinion.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-27, 261 p.

NMFS (National Marine Fisheries Service) 1996. Making Endangered Species Act determinations of effect for individual and grouped actions at the watershed scale. Habitat Conservation Program, Portland, Oregon.

Weitcamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. U.S. Dep. Commer., NOAA Tech Memo. NMFS-NWFSC-24, 258 p.

XI. Incidental Take Statement

Sections 4 (d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patters such as breeding, feeding, and sheltering. Harass is defined as actions that create the likelihood of injuring listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

A. Amount or Extent of the Take

The NMFS anticipates that the action covered by this Biological Opinion (North Medford Interchange project) has more than a negligible likelihood of resulting in incidental take of SONC coho salmon and KMP steelhead because of detrimental effects from increased sediment levels and the potential for direct incidental take during in-water work. Effects of actions such as these are largely unquantifiable in the short term, and are not expected to be measurable as long-term effects on the species' habitat or population levels. Therefore, even though NMFS expects some low level incidental take to occur due to the actions covered by this Biological Opinion, the best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take to the species itself. In instances such as these, the NMFS designates the expected level of take as "unquantifiable." Based on the information in the BA, NMFS anticipates that an unquantifiable amount of incidental take could occur as a result of the actions covered by this Biological Opinion.

B. Reasonable and Prudent Measures

The NMFS believes that the following reasonable and prudent measure(s) are necessary and appropriate to minimizing take of SONC coho salmon and KMP steelhead.

1. The ODOT shall minimize degradation of aquatic habitat in Bear Creek resulting from sedimentation and riparian vegetation removal.

2. The ODOT shall minimize the potential for direct incidental take of SONC coho salmon and KMP steelhead due to sedimentation and operation of heavy equipment in the stream channel.

3. The ODOT shall replace or mitigate for lost riparian vegetation.

C. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, ODOT must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1a. <u>All</u> site specific erosion control measures listed in the BA for the North Medford Interchange project shall be implemented.

1b. <u>All</u> general minimization/avoidance measures listed in the addendum to the BA shall be applied.

2a. All work within the active flowing channel (in-water work) shall occur between June 15 and September 15.

2b. Fish passage around the action area shall be maintained at all times.

3a. Replace as much riparian vegetation at the project site as is practicable.

3b. Implement mitigation plan listed in the BA for riparian vegetation plantings upstream of the action area.

ATTACHMENT 1

BIOLOGICAL REQUIREMENTS AND STATUS UNDER 1996 ENVIRONMENTAL BASELINE: UMPQUA RIVER CUTTHROAT TROUT, OREGON COAST COHO SALMON, OREGON COAST STEELHEAD, SOUTHERN OREGON/NORTHERN CALIFORNIA COHO SALMON, KLAMATH MOUNTAIN PROVINCE STEELHEAD, LOWER COLUMBIA STEELHEAD, AND CHUM SALMON

June 1997

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TABLE OF CONTENTS

LIST OF TABLES

I. Species Addressed in this Attachment

The Umpqua River (UR) cutthroat trout (*Oncorhynchus clarki clarki*) Evolutionarily Significant Unit (ESU)1 is listed as endangered under the Endangered Species Act (ESA) by the National Marine Fisheries Service (NMFS) (August 9, 1996, 61 FR 41514). The UR cutthroat trout ESU includes three life forms -- anadromous, potamodromous, and resident fish -- occurring below natural, impassable barriers in the Umpqua Basin (southwestern Oregon). This ESU occupies the mainstem Umpqua River, North Umpqua River, South Umpqua River, and their respective tributaries, residing below long-term, naturally impassable barriers.

On May 6, 1997, NMFS determined that the Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch)* ESU[1] was not warranted for listing under the ESA (62 FR 24588). This ESU occupies river basins on the Oregon coast north of Cape Blanco, excluding rivers and streams that are tributaries of the Columbia River. Evidence exists of genetic differentiation within this ESU, although currently there is no clear geographic pattern to this differentiation (Weitkamp *et al*. 1995). Except for the Umpqua River, which extends through the Coast Range to drain the Cascade Mountains, rivers within the range of this ESU are comparatively short and have their headwaters in the Coast Range Mountains. These rivers have a single peak flow in December or January and relatively low flow in late summer. Oregon Coast coho salmon are caught primarily in Oregon marine waters (Weitkamp *et al*. 1995).

The Southern Oregon/northern California (SONC) coho salmon (*O. kisutch*) ESU[1] has been listed as threatened under the ESA by the NMFS (May 6, 1997, 62 FR 24588). The SONC coho salmon occur between Cape Blanco, Oregon, and Punta Gorda, California.

The Klamath Mountains Province (KMP) steelhead (*O. mykiss*) ESU[1] has been proposed for listing as threatened under the ESA by the NMFS (March 16, 1995, 60 FR 14253). The final decision

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[1] For purposes of conservation under the Endangered Species Act, an Evolutionarily Significant Unit (ESU) is a distinct population segment that is substantially reproductively isolated from other conspecific population units and represents an important component in the evolutionary legacy of the species (Waples 1991).

whether to list this species has been deferred to February 1998 (62 FR 43974; August 18, 1997). The KMP steelhead occur between Cape Blanco, Oregon, and the Klamath River Basin (inclusive) in California.

The Oregon Coast (OC) steelhead (*Oncorhynchus mykiss*) ESU[1] was proposed as threatened under the ESA by the NMFS (August 9, 1996, 61 FR 41541). The NMFS issued a six-month extension for a final listing determination for OC steelhead based on substantial scientific disagreement regarding the sufficiency and accuracy of data relevant to listing this ESU (August 18, 1997, 62 FR 43974). This ESU occupies river basins on the Oregon coast north of Cape Blanco, excluding rivers and streams that are tributaries of the Columbia River.

Other salmon and steelhead ESUs have also been proposed for listing. However, this document focuses on the anadromous salmonids specified above in river basins that drain into the Pacific Ocean between the Columbia River, Oregon, and Punta Gorda, California.

II. Critical Habitat

Section 4(a)(3)(A) of the ESA requires that, to the extent prudent and determinable, critical habitat be designated concurrently with the listing of a species. In most cases the substantive protections of critical habitat designations are duplicative of those of listings. However, in cases in which critical habitat designation is deemed essential to the conservation of the species, such a designation could warrant a higher priority.

UR cutthroat trout critical habitat has been proposed (62 FR 40786; July 30, 1997) and includes: The Umpqua River from a straight line connecting the west end of the South jetty and the west end of the North jetty and including all Umpqua River estuarine areas (including the Smith River) and tributaries proceeding upstream from the Pacific Ocean to the confluence of the North and South Umpqua Rivers; the North Umpqua River, including all tributaries, from its confluence with the mainstem Umpqua River to Toketee Falls; the South Umpqua River, including all tributaries, from its confluence with the mainstem Umpqua River to its headwaters (including Cow Creek, tributary to the South Umpqua River). Critical habitat includes all waterways below longstanding, natural impassable barriers (i.e., natural water falls in existence for over several hundred years). Such areas represent the current freshwater and estuarine range of the listed species.

Critical habitat has not yet been determined for listed coho salmon or proposed steelhead. At the time of the listing proposals, the NMFS had not completed the analysis necessary to propose critical habitat. To avoid delaying the listing proposal, the NMFS stated its intent to propose critical habitat in a separate rulemaking for OC coho salmon (July 25, 1995, 60 FR 38011), SONC coho salmon (July 25, 1995, 60 FR 38011), OC steelhead (August 9, 1996, 61 FR 41559), and KMP steelhead (March 16, 1995, 60 FR 14253; August 9, 1996, 61 FR 41559).

III. Species Life History and Population Trends

A. Umpqua River Cutthroat Trout

1. Life History

a. Life Forms. Cutthroat trout have evolved to exploit habitats least preferred by other salmonid species (Johnston 1981). The life history of UR cutthroat trout is probably the most complex and flexible of any Pacific salmonid. Three life-history forms have been reported in the Umpqua River Basin: anadromous, potamodromous (river-migrating), and resident (Trotter 1989; Loomis and Anglin 1992; Loomis *et al.* 1993). Information on these three life forms is summarized below. Additional details of the coastal cutthroat trout life history and ecology can be found in published reviews by Pauley *et al.* (1989), Trotter (1989), Behnke (1992), and Johnson *et al.* (1994).

(1) Anadromous cutthroat trout. The anadromous life form migrates from fresh water to the ocean, then back to fresh water as an adult to spawn. Unlike other anadromous salmonids, anadromous cutthroat trout do not over-winter in the ocean and only rarely make long extended migrations across large bodies of water. They migrate in the nearshore marine habitat and usually remain within 10 km of land (Sumner 1972, Giger 1972, Jones 1976, Johnston 1981). While most anadromous cutthroat trout enter seawater as two- or three-year-old fish, some may remain in fresh water for up to five years before entering the ocean (Sumner 1972, Giger 1972).

(2) Potamodromous cutthroat trout. The potamodromous life form undertakes freshwater migrations of varying length without entering the ocean, and is sometimes referred to as "fluvial." Potamodromous cutthroat trout migrate only into rivers and lakes (Nicholas 1978; Tomasson 1978; Moring *et al*. 1986; Trotter 1989), even when they have access to the ocean (Tomasson 1978). The potamodromous life form is most common in rivers with physical barriers to anadromous fish (Johnson *et al*. 1994), but have also been documented below barriers in the Rogue River (Tomasson 1978) and the Umpqua River (Johnson *et al*. 1994).

(3) Resident cutthroat trout. The resident life form does not migrate long distances; instead, they remain in upper tributaries near spawning and rearing areas and maintain small home territories throughout their life cycle (Trotter 1989). Resident cutthroat trout have been observed in the upper Umpqua River drainage (Roth 1937, FCO and OSGC 1946, ODFW 1993). During a radio tagging study, Waters (1993) found that fish smaller than 180 mm maintained home ranges of less than 14 meters of stream length and moved about an average total distance of 27 meters during the study. Fish larger than 180 mm had home ranges of about 76 meters of stream length and moved and average total distance of about 166 meters. This study was conducted in three tributaries of Rock Creek on the North Umpqua River drainage.

b. Spawning and Rearing. Cutthroat trout generally spawn in the tails of pools located in small tributaries at the upper limit of spawning and rearing sites of coho salmon and steelhead. Stream conditions are typically low stream gradient and low flows, usually less than 0.3 m^3/second during the summer (Johnston 1981). Spawning timing varies among streams, but generally occurs between December and May, with a peak in February (Trotter 1989).

Cutthroat trout are iteroparous and have been documented to spawn each year for at least five years (Giger 1972). However, some cutthroat trout do not spawn every year (Giger 1972), and some remain in fresh water for at least a year before returning to seawater (Giger 1972, Tomasson 1978). Spawners may experience high post-spawning mortality due to weight loss of as much as 38% of pre-spawning mass (Sumner 1953) and other factors (Cramer 1940, Sumner 1953, Giger 1972, Scott and Crossman 1973).

Eggs begin to hatch within six to seven weeks of spawning, depending on water temperature. Alevins remain in the redds for a few additional weeks and emerge as fry between March and June, with peak emergence in mid-April (Giger 1972, Scott and Crossman 1973). Newly emerged fry are about 25 mm long. They prefer low velocity margins, backwaters, and side channels, gradually moving into pools if competing species are absent. Coho fry will drive the smaller cutthroat fry into riffles, where they will remain until decreasing water temperatures reduce the aggressiveness of the coho fry (Stolz and Schnell, 1991). Cutthroat trout overwinter in pools near log jams or overhanging banks (Bustard and Narver 1975).

c. Parr Movements. After emergence from redds, cutthroat trout juveniles generally remain in upper tributaries until they are one year of age, when they may begin extensive movements up and down streams. Directed downstream movement by parr usually begins with the first spring rains (Giger 1972), but has been documented in every month of the year (Sumner 1953, 1962, 1972; Giger 1972; Moring and Lantz 1975; Johnston and Mercer 1976; Johnston 1981). As an example, from 1960 to 1963 (Lowry 1965) and from 1966 to 1970 (Giger 1972) in the Alsea River drainage, large downstream migrations of juvenile fish began in mid-April with peak movement in mid-May. Some juveniles (parr) even entered the estuary and remained there over the summer, although they did not smolt nor migrate to the open ocean (Giger 1972). In Oregon, upstream movement of juveniles from estuaries and mainstem to tributaries begins with the onset of winter freshets during November, December, and January (Giger 1972, Moring and Lantz 1975). At this time, these one year and older juvenile fish averaged less than 200 mm in length.

d. Smoltification. Time of initial seawater entry of smolts bound for the ocean varies by locality and may be related to marine conditions or food sources (Lowry 1965, 1966; Giger 1972; Johnston and Mercer 1976; Trotter 1989). In Washington and Oregon, entry begins as early as March, peaks in mid-May, and is essentially over by mid-June (Sumner 1953, 1972; Lowry 1965; Giger 1972; Moring and Lantz 1975; Johnston 1981). Seaward migration of smolts to protected areas appears to occur at an earlier age and a smaller size than to more exposed areas. On the less protected Oregon coast, cutthroat trout tend to migrate at an older age (age three and four) and at a size of 200-255 mm (Lowry 1965, 1966; Giger 1972).

e. Timing of Umpqua River Smolt Migrations. Trap data from seven locations in the North Umpqua River in 1958 and from three locations in Steamboat Creek (a tributary of the North Umpqua River downstream of Soda Springs Dam) between 1958 and 1973 indicate that juvenile movement is similar to that reported by Lowry (1965) and Giger (1972) in other Oregon coastal rivers. Movement peaked in May and June, with a sharp decline in July, although some juveniles continued to be trapped through September and October. It is unknown whether UR cutthroat trout juveniles migrate from the upper basin areas to the estuary, but it seems unlikely considering the distance (well over 185 km) and the river conditions. The average August river temperature at Winchester Dam (on the North Umpqua River immediately upstream of the Interstate 5 highway bridge) since 1957 is 23.3°C (ODFW 1993).

f. Estuary and Ocean Migration. Migratory patterns of sea-run cutthroat trout differ from Pacific salmon in two major ways: (1) few, if any, cutthroat overwinter in the ocean; and (2) the fish do not usually make long open-ocean migrations, although they may travel considerable distances along the shoreline (Johnston 1981, Trotter 1989, Pauley *et al*. 1989). Studies by Giger (1972) and Jones (1973, 1974, 1975) indicated that cutthroat trout, whether initial or seasoned migrants, remained at sea an average of only 91 days, with a range of 5 to 158 days.

g. Adult Freshwater Migrations. In the Umpqua River, it is reported (ODFW 1993) that cutthroat trout historically began upstream migrations in late June and continued to return through January with bimodal peaks in late-July and October. Giger (1972) reported a similar return pattern, but with slightly later modal peaks (mid-August and late-October to mid-November) on the Alsea River.

h. Food. In streams, cutthroat trout feed mainly on terrestrial and aquatic insects that come to them in the drift. In the marine environment, cutthroat trout feed around gravel beaches, off the mouths of small creeks and beach trickles, around oyster beds and patches of eel grass. They primarily feed on amphipods, isopods, shrimp, stickelback, sand lance and other small fishes (Stolz and Schnell 1991).

2. Population Trends

Winchester Dam counts are currently the best quantitative measure of cutthroat trout abundance in the Umpqua River basin (Table 1). Although the dam is located on the North Umpqua River, there are several reasons to believe that the North Umpqua River has larger and healthier populations of cutthroat trout than the South Umpqua River (see Final Rule, August 9, 1996, 61 FR 41514). There have been no recently published population surveys of cutthroat trout in the Umpqua River basin. Currently there is no information available that indicates that any life form of cutthroat trout is more abundant in the mainstem Umpqua River (including the Smith River) or South Umpqua River than in the North Umpqua River.

Table 1.
Numbers of returning adult anadromous cutthroat trout passing Winchester Dam on the North Umpqua River from 1946 to 1995, and releases of Alsea River hatchery cutthroat trout immediately below Winchester Dam from 1961 to 1976, in Smith River from 1975 to 1993, and in Scholfield Creek from 1982 to 1993 (Loomis *et al*. 1993 & pers. comm.).

Year	Number of smolts released below Winchester Dam	Number of smolts released in Smith River	Number of smolts released in Scholfield Creek	Number of returning adults
1946	-	-	-	1,138
1947	-	-	-	974
1948	-	-	-	437
1949	-	-	-	439
1950	-	-	-	664
1951	-	-	-	1,508
1952	-	-	-	761
1953	-	-	-	1,838
1954	-	-	-	706
1955	-	-	-	960
1956	-	-	-	982
1957	-	-	_	87
1958	-	-	-	108
1959	-	-	-	48
1960	-	-	-	106
1961	5,000	-	-	306
1962	10,000	-	-	308
1963	10,000	-	-	142
1964	10,000	-	-	420
1965	20,000	-	-	796
1966	20,000	-	-	2,364
1967	20,000	-	-	2,200
1968	20,000	-	-	1,031
1969	20,000	-	-	942
1970	19,000	-	-	1,880

Table 1 (continued). Numbers of returning adult anadromous cutthroat trout passing Winchester Dam on the North Umpqua River from 1946 to 1995, and releases of Alsea River hatchery cutthroat trout immediately below Winchester Dam from 1961 to

1976, in Smith River from 1975 to 1993, and in Scholfield Creek from 1982 to 1993 (Loomis *et al*. 1993 & pers. comm.).

Year	Number of smolts released below Winchester Dam	Number of smolts released in Smith River	Number of smolts released in Scholfield Creek	Number of returning adults
1971	20,000	-	-	289
1972	19,000	-	-	1,094
1973	20,000	-	-	1,712
1974	20,000	-	-	622
1975	17,000	9,900	-	427
1976	9,000	7,500	-	544
1977	-	10,000	-	123
1978	-	15,100	-	104
1979	-	11,100	-	25
1980	-	12,700	-	74
1981	-	20,100	-	86
1982	-	19,100	2,600	156
1983	-	9,100	2,700	43
1984	-	15,800	4,500	104
1985	-	15,800	4,500	88
1986	-	1,200	4,000	53
1987	-	8,100	8,000	35
1988	-	11,900	4,000	47
1989	-	12,000	4,000	38
1990	-	12,000	4,000	34
1991	-	12,000	4,000	10
1992	-	12,000	4,000	0.00
1993	-	12,000	4,000	29
1994	-	-	-	5
1995	-	-	-	72

B. Coho Salmon

In contrast to the life history patterns of other anadromous salmonids, coho salmon generally exhibit a relatively simple three-year life cycle.

1. Oregon Coast Coho Salmon

a. Life History

(1). Spawn timing. Most OC coho salmon enter rivers from late September to mid-October. Coho salmon river entry timing is influenced by many factors, one of which appears to be river flow. Coho salmon wait for freshets before entering rivers, thus a delay in fall rains delays river entry and perhaps spawn timing. Peak spawning occurs anywhere from mid-November to early February.

(2) Spawning habitat and temperature. Although each native stock appears to have a unique time and temperature for spawning that theoretically maximizes offspring survival, coho salmon generally spawn at water temperatures within the range of 10-12.8°C (Bell 1991). Bjornn and Reiser (1991) found that spawning occurs in a few third-order streams, but most spawning activity was found in fourth- and fifth-order streams. Nickelson *et al*. (1992a) found that spawning occurs in tributary streams with a gradient of 3% or less. Spawning occurs in clean gravel ranging in size from that of a pea to that of an orange (Nickelson *et al*. 1992a). Spawning is concentrated in riffles or in gravel deposits at the downstream end of pools featuring suitable water depth and velocity (Weitkamp *et al*. 1995).

(3) Hatching and Emergence. The favorable range for coho salmon egg incubation is 10-12.8°C (Bell 1991). Eggs incubate for approximately 35 to 50 days, depending on water temperature, and start emerging from the gravel two to three weeks after hatching (Nickelson *et al*. 1992a).

(4) Parr movement and smoltification. Following emergence, fry move into shallow areas near the stream banks. Their territory seems to be related not only to slack water, but to objects that provide points of reference to which they can return (Hoar 1951). Juvenile rearing usually occurs in tributary streams with a gradient of 3% or less, although they may move up to streams of 4% or 5% gradient. Juveniles have been found in streams as small as one to two meters wide (November 12, 1996, personal communication, between K. Moore, Oregon Department of Fish and Wildlife (ODFW), and J. Wu, NMFS). At a length of 38-45 mm, the fry may migrate upstream a considerable distance to reach lakes or other rearing areas (Godfrey 1965; Nickelson *et al.* 1992a). Rearing requires temperatures of 20°C or less, preferably 11.7-14.4°C (Bell 1991; Reeves *et al.* 1987; Reiser and Bjornn 1979). Coho salmon fry are most abundant in backwater pools during spring. During summer, juvenile coho salmon are more abundant in pools of all types than in glides or riffles. During winter, juvenile coho salmon are most abundant in off-channel pools, beaver ponds, alcoves, and debris-dammed pools with complex cover (Nickelson *et al.* 1992b, 1992c). The ideal food channel for maximum coho smolt production would have shallow depth (7-60 cm), fairly swift mid-stream flows (60 cm/sec), numerous marginal back-eddies, narrow width (3-6 cm), copious overhanging mixed vegetation (to lower water temperatures, provide leaf-fall, and contribute terrestrial insects), and banks permitting hiding places (Boussu 1954). Juveniles rear in fresh water for up to 15 months, then migrate to the sea as smolts between February and June (Weitkamp *et al.* 1995).

(5) Estuary and Ocean Migration. Little is known about residence time or habitat use in estuaries during seaward migration, although it is usually assumed that coho salmon spend only a short time in the estuary before entering the ocean (Nickelson *et al.* 1992a). Growth is very rapid once the smolts reach the estuary (Fisher *et al.* 1984). While living in the ocean, coho salmon remain closer to their river of origin than do chinook salmon. Fisher *et al.* (1984) found that almost all of the coded-wire tagged juvenile coho salmon that had been released from coastal Oregon were recovered further north than Oregon. After about 12 months at sea, coho salmon gradually migrate south and along the coast, but some appear to follow a counter-clockwise circuit in the Gulf of Alaska (Sandercock 1991). Coho salmon typically spend two growing seasons in the ocean before returning to their natal streams to spawn as three year-olds. Some precocious males, called "jacks," return to spawn after only six months at sea.

(6) Food. The early diets of emerging fry include chironomid larvae and pupae (Mundie 1969). Juvenile coho salmon are carnivorous opportunists that primarily eat aquatic and terrestrial insects. They do not appear to pick stationary items off the substratum (Sandercock 1991; Mundie 1969).

b. Population trends

Abundance of wild coho salmon spawners in Oregon coastal streams declined during the period from about 1965 to about 1975 and has fluctuated at a low level since that time (Nickelson *et al*. 1992a). Spawning escapements for this ESU may be at less than 5% of abundance in the early 1900s. Contemporary production of coho salmon may be less than 10% of the historic production (Nickelson *et al*. 1992a). Average spawner abundance has been relatively constant since the late 1970s, but preharvest abundance has declined. Average recruits-per-spawner may also be declining. The OC coho salmon ESU, although not at immediate danger of extinction, may become endangered in the future if present trends continue (Weitkamp *et al*. 1995).

2. Southern Oregon/Northern California Coho Salmon

a. Life History

Most SONC coho salmon enter rivers between September and February and spawn from November to January (occasionally into February). Coho salmon river entry timing is influenced by many factors, one of which appears to be river flow. In addition, many small California stream systems have sandbars which block their mouths for most of the year except winter. In these systems, coho salmon and other anadromous salmonid species are unable to enter the rivers until sufficiently strong freshets break the bars (Weitcamp *et al*. 1995). Coho salmon spawn from November to January (Hassler 1987), and occasionally into February and March (Weitcamp *et al*. 1995). Spawning is concentrated in riffles or in gravel deposits at the downstream end of pools with suitable water depth and velocity.

Coho salmon eggs incubate for approximately 35 to 50 days between November and March, and start emerging from the gravel two to three weeks after hatching (Hassler 1987). Following emergence, fry move into shallow areas near the stream banks. As coho salmon fry grow larger, they disperse upstream and downstream and establish and defend a territory (Hassler 1987). During the summer, coho salmon fry prefer pools and riffles featuring adequate cover such as large woody debris, undercut banks, and overhanging vegetation. Juvenile coho salmon prefer to over-winter in large mainstem pools, backwater areas and secondary pools with large woody debris, and undercut bank areas (Hassler 1987; Heifetz *et al*. 1986). Juveniles primarily eat aquatic and terrestrial insects (Sandercock 1991). Coho salmon rear in fresh water for up to fifteen months, then migrate to the sea as smolts between March and June (Weitcamp *et al*. 1995).

While living in the ocean, coho salmon remain closer to their river of origin than do chinook salmon. Nevertheless, coho salmon have been captured several hundred to several thousand kilometers away from their natal stream (Hassler 1987). Coho salmon typically spend two growing seasons in the ocean before returning to their natal streams to spawn as three year-olds. Some precocious males, called "jacks," return to spawn after only six months at sea.

b. Population trends

Available historical and recent coho salmon abundance information is summarized in the NMFS coast-wide status review (Weitcamp *et al*. 1995). Following are some excerpts from this document.

Gold Ray Dam adult coho passage counts provide a long-term view of coho salmon abundance in the upper Rogue River. During the 1940s, counts averaged ca. 2,000 adult coho salmon per year. Between the late 1960s and early 1970s, adult counts averaged fewer than 200. During the late 1970s, dam counts increased, corresponding with returning coho salmon produced at Cole Rivers Hatchery. Coho salmon run size estimates derived from seine surveys at Huntley Park near the mouth of the Rogue River have ranged from ca. 450 to 19,200 naturally-produced adults between 1979 and 1991. In Oregon south of Cape Blanco, Nehlsen *et al*. (1991) considered all but one coho salmon stock to be at "high risk of extinction." South of Cape Blanco, Nickelson *et al*. (1992a) rated all Oregon coho salmon stocks as "depressed."

Brown and Moyle (1991) estimated that naturally-spawned adult coho salmon returning to California streams were less than one percent of their abundance at mid-century, and indigenous, wild coho salmon populations in California did not exceed 100 to 1,300 individuals. Further, they stated that 46 percent of California streams which historically supported coho salmon populations, and for which recent data were available, no longer supported runs.

No regular spawning escapement estimates exist for natural coho salmon in California streams. CDFG (1994) recently summarized most information for the northern California region of this ESU. They concluded that "coho salmon in California, including hatchery stocks, could be less than six percent of their abundance during the 1940's, and have experienced at least a 70 percent decline in the 1960's." They also reported that coho salmon populations have been virtually eliminated in many streams, and that adults are observed only every third year in some streams, suggesting that two of three brood cycles may already have been eliminated.

The rivers and tributaries in the California portion of this ESU were estimated to have average recent runs of 7,080 natural spawners and 17,156 hatchery returns, with 4,480 identified as "native" fish occurring in tributaries having little history of supplementation with non-native fish. Combining recent run-size estimates for the California portion of this ESU with Rogue River estimates provides a rough minimum run-size estimate for the entire ESU of about 10,000 natural fish and 20,000 hatchery fish.

C. Steelhead

This section is divided into Life History (for west coast steelhead) and Population Trends (for each proposed ESU).

1. Life History

a. General. Biologically, steelhead can be divided into two basic run-types, based on the state of sexual maturity at the time of river entry and duration of spawning migration (Burgner *et al*. 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (August 9, 1996, 61 FR 41542; Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, while others only have one run-type.

Steelhead spend between one and four years in the ocean (usually two years in the Pacific Southwest). Variations in this pattern occur. Some steelhead return to fresh water after only a few months at sea and are termed "half-pounders." Half-pounders generally spend the winter in fresh water and then return to sea for several months before returning to fresh water to spawn. Half-pounders occur over a relatively small geographic range in southern Oregon and northern California, including the Rogue, Klamath, Mad, and Eel Rivers (Barnhart 1986; Kesner and Barnhart 1972). Judging from tag returns, most steelhead migrate north and south in the ocean along the continental shelf (Barnhart 1986).

Summer steelhead enter fresh water between May and October in the Pacific Northwest (Busby *et al.* 1996; Nickelson *et al.* 1992a). They require cool, deep holding pools during summer and fall, prior to spawning (Nickelson *et al.* 1992a). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration in early spring to natal streams, and then spawn (Meehan and Bjornn 1991; Nickelson *et al.* 1992a).

Winter steelhead enter fresh water between November and April in the Pacific Northwest (Busby *et al.* 1996; Nickelson *et al.* 1992a), migrate to spawning areas, and then spawn in late winter or spring (Nickelson *et al.* 1992a). Some adults, however, do not enter some coastal streams until spring, just before spawning (Meehan and Bjornn 1991).

Steelhead typically spawn between December and June (Bell 1991), and there is a high degree of overlap in spawn timing between populations regardless of run type (Busby *et al.* 1996). Difficult field conditions at that time of year and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning. Unlike salmon, steelhead usually do not die soon after spawning.

b. Spawning timing and habits. Variations in migration timing exist between populations. Summer steelhead spawn in January and February and winter steelhead generally spawn in April and May (Barnhart 1986). Steelhead eggs generally incubate between February and June (Bell 1991), and typically emerge from the gravel two to three weeks after hatching (Barnhart 1996).

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (August 9, 1996, 61 FR 41542; Nickelson *et al*. 1992a). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al*. 1996). Multiple spawnings for steelhead range from 3-20% of runs in Oregon coastal streams.

c. Spawning habitat and temperature. Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986; Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973) are required to reduce disturbance and predation of spawning steelhead. It appears that summer steelhead occur where habitat is not fully utilized by winter steelhead; summer steelhead usually spawn further upstream than winter steelhead (Withler 1966; Behnke 1992).

Steelhead require a minimum depth of 0.18 m and a maximum velocity of 2.44 m/s for active upstream migration (Smith 1973). Spawning and initial rearing of juvenile steelhead generally take place in small, moderate-gradient (generally 3-5%) tributary streams (Nickelson *et al*. 1992a). A minimum depth of 0.18 m, water velocity of 0.30-0.91 m/s (Smith 1973; Thompson 1972), and clean substrate 0.6-10.2 cm (Hunter 1973; Nickelson *et al*. 1992a) are required for spawning. Steelhead spawn in 3.9-9.4°C water (Bell 1991).

d. Hatching and Emergence. Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching. Bjornn and Reiser (1991) noted that steelhead eggs incubate about 85 days at 4°C and 26 days at 12°C to reach 50% hatch. Nickelson *et al*. (1992a) stated that eggs hatch in 35-50 days, depending upon water temperature. After two to three weeks, in late spring, and following yolk sac absorption, alevins emerge from the gravel as fry and begin actively feeding. Fry occupy stream margins (Nickelson *et al.* 1992a).

Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992a).

e. Parr movement and smoltification. Steelhead prefer water temperatures ranging from 12-15°C (Reeves *et al.* 1987). Juveniles rear in fresh water from one to four years, then migrate to the ocean as smolts (August 9, 1996, 61 FR 41542). Winter steelhead populations generally smolt after two years in fresh water (Busby *et al.* 1996). Steelhead smolts are usually 15-20 cm total length and migrate to the ocean in the spring (Meehan and Bjornn 1991).

f. Estuary and Ocean Migration. Steelhead typically reside in marine waters for two or three years prior to returning to their natal stream to spawn as four- or five-year olds (August 9, 1996, 61 FR 41542). Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby *et al.* 1996). Age structure appears to be similar to other west coast steelhead, dominated by four-year-old spawners (Busby *et al.* 1996).

Based on purse seine catch, juvenile steelhead tend to migrate directly offshore during their first summer from whatever point they enter the ocean rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988; Pearcy *et al.* 1990; Pearcy 1992).

g. Food. Juvenile steelhead feed on a wide variety of aquatic and terrestrial insects (Chapman and Bjornn 1969). Steelhead hold territories close to the substratum where flows are low and sometimes counter to the main stream; from these, they can make forays up into surface currents to take drifting food (Kalleberg 1958).

2. Population Trends

a. Oregon Coast Steelhead

Production of steelhead in nine Oregon coastal river basins (Coquille River north) was probably about 100,000 adults annually from 1930-1939. Contemporary (1980-1989) production in these same basins is probably about 50,000 wild adults annually (Nickelson *et al.* 1992a). Light (1987) estimated total run size for the major stocks on the Oregon Coast (including areas south of Cape Blanco) for the early 1980s as approximately 255,000 winter steelhead and 75,000 summer steelhead. Light (1987) estimated that 69% of winter and 61% of summer steelhead were of hatchery origin, resulting in naturally produced run sizes of 79,000 winter steelhead and 29,000 summer steelhead. Total recent (5-year average) run size for major streams in this ESU was approximately 129,000 (111,000 winter steelhead and 18,000 summer steelhead), with a total escapement of 96,000 (82,000 winter steelhead and 14,000 summer steelhead). These totals do not include all streams in the ESU, so total ESU run size and escapement is underestimated (Light 1987). Run size and escapement estimates are also based primarily on expansion of angler catch using assumed harvest rates (Kenaston 1989), so they should be viewed as rough approximations. Appendix E of Busby *et al.* (1996) provides a summary of steelhead abundance data considered by ESU and river basin.

Adequate adult escapement information was available to compute trends for 42 independent stocks within this ESU. Of these, 36 data series exhibit declines and six exhibit increases over the available data series, with a range from 12% annual decline (Drift Creek on the Siletz River) to 16% annual increase (North Fork Coquille River). Twenty (eighteen decreasing, two increasing) of these trends were significantly different from zero. Upward trends were only found in the southernmost portion of the ESU, from Siuslaw Bay south (August 9, 1996, 61 FR 41551).

There is widespread production of hatchery steelhead within this ESU, largely based on out-of-basin stocks, and approximately half of the streams (including the majority of those with upward trends) are estimated to have more than 50% hatchery fish in natural spawning escapements. Given the substantial contribution of hatchery fish to natural spawning throughout the ESU, and the generally declining or slightly increasing trends in abundance, it is likely that natural stocks are not replacing themselves throughout the ESU (Busby *et al*. 1996).

The OC steelhead ESU, although not presently in danger of extinction, is likely to become endangered in the foreseeable future (Busby *et al*. 1996).

b. Klamath Mountain Province Steelhead

Available historical and recent KMP steelhead abundance information is summarized in Busby *et al*. (1994). Following are some excerpts from this document.

Historical information on KMP steelhead abundance is quite scarce. Rivers (1957, 1963) noted that downstream migrant steelhead were abundant in the Rogue River Basin. However, Snyder (1925) noted that trout (including steelhead) were declining in the Klamath River Basin.

The Rogue River presently has both winter- and summer-run steelhead. Recent abundance estimates were derived from angler catch estimates, adult passage counts at Gold Ray Dam on the upper Rogue River, and summer steelhead surveys at Huntley Park near the river mouth. From angler catch data, 1980-85 natural winter steelhead run sizes averaged 3,200 in the lower Rogue and 1,500 in the upper Rogue River. For summer steelhead, estimated average 1987-91 run sizes for natural fish were 10,300 in the lower Rogue and 5,200 in the upper Rogue River. Recent (1981-91) natural winter steelhead counts at Gold Ray Dam ranged from 2,900-12,700 and natural summer-run steelhead run sizes ranged from 3,200-13,000. Between 1970 and 1991, angler catch of winter-run steelhead declined at an average rate of ca. 5% per year while catch of summer-run steelhead increased ca. 2% per year. During a similar period, winter-run counts at Gold Ray Dam increased by less than 1% and summer-run counts increased ca. 3% per year, while estimates of summer-run steelhead passing Huntley Park declined by ca. 3% per year. Nehlsen *et al*. (1991) listed summer-run steelhead in the Rogue river as at "moderate risk of extinction." The ODFW described Rogue River winter steelhead as "healthy" and summer steelhead as "depressed" (Nickelson *et al*. 1992a).

The Applegate River presently has both winter- and summer-run steelhead. Recent abundance estimates were derived from angler catch estimates. The 1980-85 estimated natural winter steelhead run size averaged 800, and the natural summer steelhead run size estimate averaged 1,300. Summer-run angler catch showed no significant decline between 1970 and 1991, while the winter-run catch declined at an average rate of ca. 2% per year.

The Illinois River presently has only winter-run steelhead. Recent abundance estimates were derived from angler catch estimates. During the 1980-85 period, the estimated natural winter steelhead run size was 6,300. Angler catch declined at an average rate of ca. 10% per year. Nehlsen *et al.* (1991) listed winter-run steelhead in the Illinois River as at "moderate risk of extinction," and ODFW described this population as "depressed" (Nickelson *et al.* 1992a).

Hunter Creek has only winter-run steelhead. Recent abundance estimates were derived from angler catch estimates. Between 1980 and 1985, the estimated natural winter steelhead run size was ca. 500, and angler catch declined at an average rate of ca. 6% per year between 1970 and 1991.

The Pistol River has only winter-run steelhead. Recent abundance estimates were derived from angler catch estimates. Estimated 1980-85 natural winter steelhead runs averaged ca. 1,200, and angler catch rate declined at an average rate of ca. 3% per year between 1970 and 1991.

The Chetco River has only winter-run steelhead. Recent abundance estimates were derived from angler catch estimates. Estimated 1980-85 natural winter steelhead runs averaged ca. 3,200, and angler catch declined at an average rate of less than 1% per year between 1970 and 1991. The ODFW described this population as "depressed" (Nickelson *et al.* 1992a).

The Winchuck River has only winter-run steelhead. Recent abundance estimates were derived from angler catch estimates. The average estimated natural winter steelhead run size between 1980 and 1985 was 400, and angler catch declined at an average rate of ca. 4% per year between 1970 and 1991. The ODFW described this population as "healthy" (Nickelson *et al.* 1992a).

The Smith River presently has both winter- and summer-run steelhead. Within the Smith River, spawning escapement was estimated to be about 30,000 in the early 1960s, although this estimate is not based on direct observations. Recent summer diver counts which index only summer steelhead indicate variation from year to year and there is insufficient information to calculate a natural return ratio for this stock. Nehlsen *et al.* (1991) listed summer-run steelhead in the Smith River as at "high risk of extinction." U.S. Forest Service (USFS) biologists described the Smith River winter-run steelhead as low but stable (USDA-FS 1993a, 1993b).

The Klamath River has both winter- and summer-run steelhead. Spawning escapement (excluding the Trinity River) was estimated to be about 171,000 (150,000 mainstem, 21,000 tributaries) in the early 1960s, although this estimate is not based on direct observations. Total run size estimates for the 1977 to 1983 period ranged from 87,000 to 181,000, with an average of 129,000. For the early 1980s, winter-run steelhead abundance was estimated at between 10,000 and 30,000. Recent abundance estimates were derived from weir counts at Shasta River and Bogus Creek (tributaries of the Klamath River), returns to Iron Gate Hatchery, and summer diver surveys which index only early summer-run steelhead. Summer steelhead survey counts have declined an average of 3% per year since 1980. Weir counts index natural fall-run steelhead. The Shasta River weir counts showed a strong decline (average 15% per year) since 1977 and Bogus Creek weir counts were low with a slight decline. Returns to Iron Gate Hatchery had been increasing at ca. 2% per year since 1963, but show a strong decline since 1987. Nehlsen *et al.* (1991) listed summer-run steelhead in the Klamath River as at "moderate risk of extinction." USFS biologists described Klamath River winter-run steelhead stocks as low and possibly declining (but with insufficient information for a clear assessment) (USDA-FS 1993a, 1996b). Citing declining total run sizes and the increasing hatchery component of the runs, Barnhart (1994) noted that wild stocks of Klamath River steelhead may be at all time low levels.

c. Lower Columbia Steelhead

Available historical and recent LC steelhead abundance information is summarized in Busby *et al.* (1994)(this ESU extends into Washington and Eastern Oregon). No estimates of historical (pre-1960s) abundance specific to this ESU are available. Because of their limited distribution in upper tributaries and the urbanization surrounding the lower tributaries (e.g., the lower Willamette, Clackamas, and Sandy

Rivers run through Portland or its suburbs), summer steelhead appear to be at more risk from habitat degradation than are winter steelhead. The lower Willamette, Clackamas, and Sandy steelhead trends are stable or slightly increasing, but this is based on angler surveys for a limited time period, and may not reflect trends in underlying population abundance. Total annual run size data are only available for the Clackamas River (1,300 winter steelhead, 70% hatchery; 3,500 wild summer steelhead).

D. Chum Salmon

1. Life History

a. Adult Freshwater Migration. Adults spend little time in nearshore coastal waters before they begin their upstream migration to the spawning grounds (Hale 1981). Returning adults cease feeding upon entry to fresh water, and generally travel about 20 km per day (Hart 1973). Upstream migration occurs at temperatures between 8.3°C and 21.1°C, although migration at the upper extreme may be delayed (Bell 1991; Salo 1991; Meehan and Bjornn 1991). Reiser and Bjornn (1979) noted an optimum temperature of 10.1°C. Chum salmon usually leave marine waters in summer and late fall to begin their upstream migration. Adults exhibit strong homing behavior. Most chum salmon spawn above the saltwater zone, but within 200 km of the sea (Pauley *et al.* 1988).

b. Spawning. Many stocks, including the Tillamook Bay stock, show an alternating age of maturity. Spawning adults are usually between three and five years of age; occasional two-, six-, and seven-year-old spawners have been documented. Males usually predominate early in the run and females late in the run, although the overall ratio of males to females approaches 1:1 over the entire spawning season (Henry 1954; Bakkala 1970). Henry (1954) reported that older fish appeared later in the run than younger fish at Tillamook Bay, Oregon. In the Oregon coast, chum salmon usually spawn from November to early December (Henry 1953; Lannan 1980). Chum salmon do not jump and cannot pass a barrier of significant height. Spawning occurs in the lower reaches of streams of various sizes, often just above the tidal zone. Chum salmon spawn in water temperatures ranging from 7.2°C to 12.7°C (Reiser and Bjornn 1979). Chum salmon redds range from 0.3 to 4.5 m^2, averaging about 2.3 m^2. A spawning pair may require a total area of 9.2 m^2 (Burner 1951). Eggs are deposited in clean, loose gravels varying from 1.3 to 10.2 cm, depending mostly on fish size (Reiser and Bjornn 1979). Spawning takes place in water velocities varying between 46 to 101 cm/s (Smith 1973; Reiser and Bjornn 1979). One of the greatest threats to eggs and embryos is streamflow fluctuation (Bell 1991; Salo 1991; Meehan and Bjornn 1991; Nickelson *et al*. 1992a). The average water depth over chum salmon redds in Oregon streams was 30 cm (Smith 1973). Chum salmon spend 11 to 18 days in freshwater from time of stream entry to death (Mattson *et al*. 1964).

c. Incubation, Emergence, Juvenile Movement, and Rearing. Chum salmon eggs require about 400-600 temperature units (TU = the average number of degrees above 0°C during a 24-hour period) to hatch (Salo 1991). Chum salmon eggs hatch in 31-46 days at 7.2°C. Egg survival is thought to be best at 4.4°C to 14°C (Koski 1975; Reiser and Bjornn 1979; Schroder 1973). The alevins remain in the gravel about 54-77 days until yolk sac absorption is completed (Nickelson *et al*. 1992a), approximately 700-1000 TU (Salo 1991) before emerging. Chum salmon fry typically emerge during nighttime hours (Salo 1991), from March to May. While in fresh water, fry feed mostly on chironomid larvae, mayfly nymphs, stonefly nymphs, caddisfly larvae, black fly larvae, and some terrestrial insects. After absorption of the yolk sac, chum salmon can tolerate full-strength seawater (Weishart 1978). Migration to estuarine areas occurs within a few days to several weeks from emergence. Most fry leave fresh water in April and May. Migrating juveniles prefer water temperatures of 10°C, although migration occurs between 6.2°C and 13.3°C. Juveniles are capable of tolerating a range of salinities and linger in estuarine areas until entering water of higher salinity. Juveniles are attracted to shaded, dark areas (Bell 1991; Salo 1991; Meehan and Bjornn 1991), and outmigration occurs mainly at night (Pauley *et al*. 1988).

d. Smoltification. Because most chum salmon begin to migrate to marine waters as juveniles, they feed very little in freshwater (LeBrasseur and Parker 1964). Juvenile ocean entry is strongly correlated with warming of nearshore waters and the accompanying plankton blooms. Size-selective feeding occurs in the estuary and in shallow nearshore marine areas. Juveniles are supported by a detritus-based food web, with harpacticoid copepods, gammarid amphipods, cumaceans, and mysids composing most of the diet (Feller and Kaczynski 1975; Gerke and Kaczynski 1972; Salo 1991; Simenstad and Kenny 1978). Fry usually remain in estuaries until mid- or late summer before entering the offshore ocean environment (Pauley *et al*. 1988). Migration of chum fry to saltwater is obligatory within the first summer after hatching, and they will die if kept in freshwater for seven to eight months after hatching (Houston 1961). Hoar (1976) reported that chum salmon appear to have a physiological requirement for seawater three to four months after emergence if normal development is to proceed.

e. Ocean Migration. Chum salmon originating from Oregon and Washington migrate northward and are widely distributed in the Gulf of Alaska as far west as the central Aleutian Islands, with a southern limit of about 40° to 44°N latitude (Pauley *et al*. 1988). There, chum salmon feed on amphipods, euphausiids, pteropods, copepods, fish, and squid larvae (Bakkala 1970). Peterson *et al*. (1982) found that an euphausiid, *Thysanoessa spinifera*, and a hyperiid amphipod, *Hyperoche medusarum*, were the primary food items of juvenile chum salmon off the coast of Oregon. LeBrasseur (1966) suggested that feeding habits and difference in stomach contents of adult chum salmon in offshore areas were based on availability rather than on preferences for certain kinds of organisms.

2. Population trends

The largest runs of chum salmon in Oregon are in the Tillamook Bay system, most notably the Miami and Kilchis rivers. Other systems supporting significant populations of chum salmon are the Nehalem River, the Nestucca River, Netarts Bay and tributaries, and tributaries to Sand Lake. Smaller populations occur in Neskowin Creek and the Necanicum, Salmon, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, and Coquille rivers (Salo 1991; Nickelson *et al*. 1992a).

Chum salmon were formerly abundant in most mid- and north coastal Oregon rivers and lower Columbia River tributaries. Nickelson *et al.* (1992a) estimate the 1948 Tillamook Bay population to have been 219,459 fish. Over the last 35 years, these populations have significantly declined. Several local populations are on the verge of extinction. Nickelson *et al.* (1992a) estimate the 1991 Tillamook Bay chum salmon population to have been 17,266 fish. Oregon chum salmon contribute an average of 1% of the commercial harvest (Pauley *et al.* 1988). This analysis was performed in conjunction with analyses of effects to Oregon Coast coho salmon and Oregon Coast steelhead. Although the habitat requirements of chum salmon differ from those of coho salmon and steelhead, this analysis conservatively assumes that project effects will be similar. Therefore, any project is assumed to have the same effect on chum salmon as it has on Oregon Coast coho salmon and Oregon Coast steelhead.

IV. Biological Requirements for Cutthroat Trout, Coho Salmon, Steelhead, and Chum Salmon

The biological requirements of UR cutthroat trout, OC coho salmon, SONC coho salmon, OC steelhead, KMP steelhead, LC steelhead, and chum salmon (hereinafter referred to as "anadromous salmonids") can be expressed in terms of environmental factors that define properly functioning freshwater aquatic habitat necessary for survival and recovery of the populations. Individual environmental factors include water quality, habitat access, physical habitat elements, channel condition, and hydrology. Properly functioning watersheds, where all of the individual factors operate together to provide healthy aquatic ecosystems, are also necessary for the survival and recovery of anadromous salmonids.

NMFS, in collaboration with the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and the U. S. Fish and Wildlife Service (USFWS), has developed a method of evaluating the functional potential and current conditions of individual environmental factors and watersheds (NMFS 1996). The method includes a "Matrix of Pathways and Indicators" (Matrix), which is a set of aquatic, riparian, and watershed elements, and generalized ranges of potential functional values (i.e., "properly functioning," "at risk," and "not properly functioning") for each of the elements. NMFS acknowledges that the values provided in this generalized Matrix are not appropriate for all watersheds within the ranges of Pacific salmonids. Interagency field-level teams (Level 1 teams) are encouraged to modify the general Matrix as necessary to reflect local geologic and climactic influences on aquatic habitat and watershed conditions within specific physiographic areas. The "properly functioning" values developed by the Level 1 teams represent the best information for defining the biological requirements of anadromous salmonids in terms of environmental factors necessary for sufficient prespawning survival, egg-to-smolt survival, and upstream/downstream migration survival rates to ensure survival and recovery of the species. NMFS (1996) also includes a checklist for documenting the action area environmental baseline for individual or grouped actions (i.e., level of current element function) as well as determining expected effects (i.e., "restore," "maintain," or "degrade" current element function) of the proposed action (Checklist). These determinations are made through use of the Matrix. To ensure that the combined effects of all actions (implemented through time) are considered, the environmental baseline should be established on the watershed-scale.

Table 2. Matrix of pathways and indicators.

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Water Quality:	Temperature	50-57° F[1]	57-60° (spawning) 57-64° (migration &rearing)[2]	> 60° (spawning) > 64° (migration & rearing)[2]
	Sediment/turbidity	< 12% fines (<0.85mm) in gravel3, turbidity low	12-17% (west-side)[3], 12-20% (east-side)[2], turbidity moderate	>17% (west-side)[3], >20% (east side)[2] fines at surface or depth in spawning habitat2, turbidity high
	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[5]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[5]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[5]
Habitat Access:	Physical Barriers	any man-made barriers present in watershed; allow upstream and downstream fish passage at all flows	any man-made barriers present in watershed; do not allow upstream and/or downstream fish passage at base/low flows	any man-made barriers present in watershed; do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements:	Substrate	dominant substrate is gravel or cobble (interstitial spaces clear), or embeddedness <20%[3]	gravel and cobble is subdominant, or if dominant, embeddedness 20-30%[3]	bedrock, sand, silt or small gravel dominant, or if gravel and cobble dominant, embeddedness >30%[2]
	Large Woody Debris	Coast: >80 pieces/mile >24"diameter >50 ft. length[4]; East-side: >20 pieces/ mile >12"diameter >35 ft. length[2]; and adequate sources of woody debris recruitment in riparian areas	currently meets standards for properly functioning, but lacks potential sources from riparian areas of woody debris recruitment to maintain that standard	does not meet standards for properly functioning and lacks potential large woody debris recruitment

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Habitat Elements:	Pool Frequency channel width # pools/mile[6] 5 feet 184 10 " 96 15 " 70 20 " 56 25 " 47 50 " 26 75 " 23 100 " 18	meets pool frequency standards (left) and large woody debris recruitment standards for properly functioning habitat (above)	meets pool frequency standards but large woody debris recruitment inadequate to maintain pools over time	does not meet pool frequency standards
	Pool Quality	pools >1 meter deep (holding pools) with good cover and cool water[3], minor reduction of pool volume by fine sediment	few deeper pools (>1 meter) present or inadequate cover/temperature[3], moderate reduction of pool volume by fine sediment	no deep pools (>1 meter) and inadequate cover/temperature[3], major reduction of pool volume by fine sediment
	Off-channel Habitat	backwaters with cover, and low energy off-channel areas (ponds, oxbows, etc.)[3]	some backwaters and high energy side channels[3]	few or no backwaters, no off-channel ponds[3]
	Refugia (important remnant habitat for sensitive aquatic species)	habitat refugia exist and are adequately buffered (e.g., by intact riparian reserves); existing refugia are sufficient in size, number and connectivity to maintain viable populations or sub-populations[7]	habitat refugia exist but are not adequately buffered (e.g., by intact riparian reserves); existing refugia are insufficient in size, number and connectivity to maintain viable populations or sub-populations[7]	adequate habitat refugia do not exist[7]
Channel Condition & Dynamics:	Width/Depth Ratio	<10[2,4]	10-12 (we are unaware of any criteria to reference)	>12 (we are unaware of any criteria to reference)
	Streambank Condition	>90% stable; i.e., on average, less than 10% of banks are actively eroding[2]	80-90% stable	<80% stable

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Channel Condition & Dynamics:	Floodplain Connectivity	off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly
Flow/Hydrology:	Change in Peak/ Base Flows	watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of similar size, geology and geography	some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography	pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography
	Increase in Drainage Network	zero or minimum increases in drainage network density due to roads[8,9]	moderate increases in drainage network density due to roads (e.g., . 5%)[8,9]	significant increases in drainage network density due to roads (e.g., . 20-25%)[8,9]
Watershed Conditions:	Road Density & Location	<2 mi/mi^2[11], no valley bottom roads	2-3 mi/mi^2, some valley bottom roads	>3 mi/mi^2, many valley bottom roads
	Disturbance History	<15% ECA (entire watershed) with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area (except AMAs), $15% retention of LSOG in watershed[10]	<15% ECA (entire watershed) but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area (except AMAs), $15% retention of LSOG in watershed[10]	>15% ECA (entire watershed) and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; does not meet NWFP standard for LSOG retention

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Watershed Conditions:	Riparian Reserves	the riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in all subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% intact),and/or for grazing impacts: percent similarity of riparian vegetation to the potential natural community/ composition >50%[12]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system, or incomplete protection of habitats and refugia for sensitive aquatic species (.70-80% intact), and/or for grazing impacts: percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better[12]	riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia for sensitive aquatic species (<70% intact), and/or for grazing impacts: percent similarity of riparian vegetation to the potential natural community/composition <25%[12]

[1] Bjornn, T.C. and D.W. Reiser, 1991. Habitat Requirements of Salmonids in Streams. American Fisheries Society Special Publication 19:83-138. Meehan, W.R., ed.
[2] Biological Opinion on Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests.March 1, 1995.
[3] Washington Timber/Fish Wildlife Cooperative Monitoring Evaluation and Research Committee, 1993. Watershed Analysis Manual (Version 2.0). Washington Department of Natural Resources.
[4] Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.
[5] A Federal Agency Guide for Pilot Watershed Analysis (Version 1.2), 1994.
[6] USDA Forest Service, 1994. Section 7 Fish Habitat Monitoring Protocol for the Upper Columbia River Basin.
[7] Frissell, C.A., Liss, W.J., and David Bayles, 1993. An Integrated Biophysical Strategy for Ecological Restoration of Large Watersheds. Proceedings from the Symposium on Changing Roles in Water Resources Management and Policy, June 27-30, 1993 (American Water Resources Association), p. 449-456.
[8] Wemple, B.C., 1994. Hydrologic Integration of Forest Roads with Stream Networks in Two Basins, Western Cascades, Oregon. M.S. Thesis, Geosciences Department, Oregon State University.
[9] e.g., see Elk River Watershed Analysis Report, 1995. Siskiyou National Forest, Oregon.
[10] Northwest Forest Plan, 1994. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. USDA Forest Service and USDI Bureau of Land Management.
[11] USDA Forest Service, 1993. Determining the Risk of Cumulative Watershed Effects Resulting from Multiple Activities.
[12] Winward, A.H., 1989 Ecological Status of Vegetation as a base for Multiple Product Management. Abstracts 42nd annual meeting, Society for Range Management, Billings MT, Denver CO: Society For Range Management: p277.

When using the Matrix and Checklist, biologists may emphasize certain habitat elements during analyses, depending on the particular anadromous fish species of concern. In these cases, it is important to consider information that has been compiled about the habitat usage of these individual species.

For example, others have summarized the general habitat usage of coho salmon by freshwater life stage, environmental factors that affect production, and potential mechanisms of mortality (Lestelle *et al*. 1995). In addition to noting habitat usage, Lestelle *et al*. (1995) also characterized the general migratory patterns of pre-smolt life stages of coho salmon between habitat types. Egg incubation, summer rearing, and over-wintering life stages are redistributed between mainstem (lower and upper), tributary (low and high gradient), and off-channel pond habitat during spring dispersal and fall redistribution periods. This highlights that all these habitat types are utilized by coho salmon and the varying temporal importance of these habitats. Although Lestelle *et al*. (1995) focused in part on different areas of the Clearwater River system, the concepts presented in the authors' discussion apply to other areas.

By considering the Lestelle *et al*. (1995) description of the environmental factors (relevant to freshwater habitat) that affect coho production, and potential mechanisms of mortality (Table 3), the biological requirements of coho salmon, by life-stage, are further revealed:

Life stage	Habitat requirements
Egg to fry	- Relatively stable substrate - Low amount of fine sediment in spawning gravels - Low substrate embeddedness - Appropriate water temperatures and peak flow timing
Fry to parr	- Suitable colonization habitat - Low predation - Appropriate flow dynamics - Appropriate nutrient loading

Parr to smolt	- Suitable winter refuge habitat - Appropriate fall and winter flows and temperatures - Low predation

After emergence, coho salmon occupy low velocity stream margins near cover, and gradually colonize pool habitat as they grow larger. Age 0+ coho salmon have a strong preference for low velocity pools and cover during the summer (Bisson *et al.* 1988).

Table 3. Summary of environmental factors affecting freshwater habitat capacity and related density-independent survival by life stage of coho salmon. Potential mechanisms of mortality are also shown (Lestelle *et al.* 1995).

Life Stage	Factors affecting population productivity	Potential mechanisms affecting survival
Egg to emergent fry	Substrate stability, amount of fine sediment in spawning gravels, spawning gravel permeability, water temperature, peak flows	High flow events cause loss of eggs due to streambed scour and shifting (Tagart 1984); reduced flow and DO levels to eggs due to high sedimentation cause increased mortality (Tagart 1984); high fine sediment levels cause entombment of fry (Phillips *et al.* 1975); increased temperatures advance emergence timing, thereby affecting survival in next life stage (Holtby 1988); anchor ice reduces water exchange in redd causing low DO levels and/or eggs to freeze (Bjornn and Reiser 1991).
Emergent fry to September parr	Flow dynamics during emergence period, stream gradient, number of sites suitable for fry colonization, predators, temperature[1], nutrient loading[1]	Loss of emergent fry occurs due to being displaced downstream by high flows (Holtby 1988); advanced emergence timing causes fry to encounter higher flows (Holtby 1988); high gradient and lack of suitable colonization sites for emergence fry cause fry to move downstream increasing risk of predation (Au 1972; Bjornn and Reiser 1991); stranding and death due to dewatering (Bottom *et al.* 1985); loss to predators (McFadden 1969); excessive temperatures promote disease and cause mortality (Bjornn and Reiser 1991); temperature and nutrient changes affect growth thereby affecting other causes of density-independent loss (Bjornn and Reiser 1991; Hicks *et al.* 1991).
September parr to smolt	Fall and winter flows, number of accessible winter refuge sites, temperature, predators	Displacement during high flows (Scarlett and Cederholm 1984); stranding and death due to dewatering (Bottom *et al.* 1985; Cederholm *et al.* 1988); loss to predators (Zarnowitz and Raedeke 1984); loss due to poor health associated with winter conditions (Hartman and Scrivener 1990).[1]

[1] Effects likely have both density-independent and dependent components.

During the fall, juvenile coho salmon typically migrate downstream and into off-channel refugia (Cederholm and Scarlett 1982), or areas with complex cover (McMahon and Hartman 1989). Juveniles leave winter habitat and migrate to sea at the end of their first year.

Similar considerations could be developed for other anadromous salmonids of concern, e.g., summer-run steelhead. Returning adult summer-run steelhead enter river systems during the summer and occupy holding areas until they spawn. Preferred holding areas are deep pools with moderate to high velocity and good cover components. Juveniles do not migrate extensively during their first summer and occupy a wide range of habitats with moderate to high velocities and variable depth (Bisson *et al.* 1988). The highest density of age 0+ juveniles tend to be in backwater pool areas. During the winter, juveniles in larger streams generally seek refuge in the interstices of gravel and cobble substrate, while some juveniles migrate to smaller terrace tributaries (Cederholm and Scarlett 1982). During their second summer, age 1+ juveniles occurring in small streams prefer scour pools, plunge pools, and cascades (Bisson *et al.* 1988), and in large streams these fish also occupy boulder riffles and runs (Collins *et al.* 1994).

In light of the above and other available information, NMFS recommends systematically considering the various habitat requirements of all freshwater life stages of coho salmon, steelhead, and chum salmon (e.g., deep pools with adequate to complex cover, and off-channel over-wintering habitat) during use of the Matrix and Checklist. In this way, all opportunities for maintaining and improving the freshwater productivity of the anadromous salmonids should be identified and individual and grouped land management actions (and other human activities) may be modified accordingly. As Lestelle *et al.* (1995) pointed out, "improvements in survival of one life stage can be used to make up for irreversible losses that have occurred in another," and "any improvement in *density-independent survival* at any life stage will increase productivity over the entire life cycle."

V. Species Status Under Environmental Baseline

In the second step of conducting ESA section 7(a)(2) analyses (as discussed in NMFS 1996), NMFS analyzes the effects of past and ongoing human and natural factors which have led to the current status of the species and its habitat. This “environmental baseline”, to which the effects of the proposed action are added, "includes the past and present impacts of all Federal, state, or private activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process" 50 C.F.R. § 402.02 ("effects of the action"). The "Matrix of Pathways and Indicators" described above provides a method for characterizing the environmental baseline in terms of current functional conditions of instream, riparian and watershed elements in the action area (NMFS 1996).

When developing the "Matrix of Pathways and Indicators", NMFS utilized the best available information on aquatic ecosystems for coastal salmonid habitats. This information was developed by aquatic scientists when formulating the Northwest Forest Plan2 (NFP). The Report of the Forest Ecosystem Management Assessment Team (FEMAT 1993) described myriad anthropogenic factors that have contributed to the degraded conditions and ecological stress currently exhibited by coastal aquatic ecosystems throughout the NFP area, including the Umpqua River Basin. Among the factors described that are directly relevant to Umpqua River cutthroat trout are: loss of large wood recruitment (from riparian habitat degradation); degradation of water quality, especially temperature and sedimentation (from removal of riparian vegetation and road building); altered streamflows (changes in the timing, magnitude, duration and spatial distribution of peak and low flows from timber harvest); and the loss of instream habitat

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[2] Documentation of the aquatic analyses underlying the Northwest Forest Plan can be found in Forest Ecosystem Management: An Ecological, Economic, and Social Assessment (Report of the Forest Ecosystem Management Assessment Team); the Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl ; and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.

complexity (loss of pools and sinuosity from timber harvest and road building activities).

The FEMAT analysis acknowledged that in order to provide for the survival and recovery of at-risk resident and anadromous fish stocks in the face of a severely degraded environmental baseline, an immediate and aggressive effort to implement sweeping changes in land management practices on federal lands would be necessary. For this reason the Aquatic Conservation Strategy objectives (ACS), a cornerstone feature of the NFP, were developed. The ACS was specifically designed to protect salmonid habitat on federal lands managed by the USFS and BLM within the range of the northern spotted owl by restoring and maintaining the ecological health of watersheds and aquatic ecosystems. While the ACS objectives were developed for the Federal land management agencies, NMFS views the ACS as necessary for recovery of coastal salmonids across all jurisdictions (i.e. Federal, state, local and private), and applies these objectives when evaluating proposed actions that concern anadromous species.

The ACS is based on nine objectives designed to maintain (prevent further degradation of) ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and to restore currently degraded habitats (Table 3). The ACS objectives are listed below.

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the

biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Based on the aquatic habitat analysis presented in the FEMAT Report, it is unlikely that all of the biological requirements for Umpqua River cutthroat trout (i.e., properly functioning aquatic habitat across all ownerships in the Umpqua River Basin) will be met in the next ten years. Because the ACS is based on natural disturbance and recovery processes, the NFP recognized that it may take decades, possibly more than a century, to accomplish all of its objectives. Some improvements in aquatic ecosystems, however, can be expected in ten to twenty years. Aquatic scientists and species experts determined that the NFP, as described in the Record of Decision, would result in an 80 percent probability of achieving habitat of sufficient quality, distribution, and abundance to allow anadromous cutthroat trout populations to stabilize. Because of similar habitat requirements, NMFS believes that a similar outcome for all Umpqua River cutthroat trout life forms could reasonably be expected from implementation of NFP conservation measures across all land ownerships. Assuring that all actions promote attainment of ACS objectives is pivotal in determining whether actions would be likely to jeopardize listed Umpqua River cutthroat trout.

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ATTACHMENT 2

APPLICATION OF ENDANGERED SPECIES ACT STANDARDS TO: UMPQUA RIVER CUTTHROAT TROUT, OREGON COAST COHO SALMON, SOUTHERN OREGON/NORTHERN CALIFORNIA COHO SALMON, OREGON COAST STEELHEAD, KLAMATH MOUNTAIN PROVINCE STEELHEAD, LOWER COLUMBIA STEELHEAD, CHUM SALMON, CHINOOK SALMON, AND SEA-RUN CUTTHROAT TROUT

February 1997

National Marine Fisheries Service
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TABLE OF CONTENTS

A. Introduction

The National Marine Fisheries Service (NMFS) evaluates the effects of Federal actions on Umpqua River (UR) cutthroat trout (*Oncorhynchus clarki clarki*), Oregon Coast (OC) coho salmon (*O. kisutch*), Southern Oregon/Northern California (SONC) coho salmon (*O. kisutch*), Oregon Coast (OC) steelhead (*O. mykiss*), Klamath Mountain Province (KMP) steelhead (*O. mykiss*), Lower Columbia (LC) steelhead (*O. mykiss*), chum salmon (*O. keta*), chinook salmon (*O. tshawytcha*), and sea-run cutthroat trout (*O. clarki clarki*) by applying the standards of Section 7(a)(2) of the Endangered Species Act (ESA), 16 U.S.C. 1536(a)(2), and implementing regulations at 50 C.F.R. Part 402. In applying these standards, NMFS uses the best scientific and commercial data available to determine whether a proposed Federal action is likely to (1) jeopardize the continued existence of a proposed or listed species, or (2) destroy or adversely modify the proposed or designated critical habitat of such species (of the species listed above, critical habitat has only been proposed UR cutthroat trout).

B. Definition of Jeopardy and Destruction/Adverse Modification of Critical Habitat

The joint NMFS/U.S. Fish and Wildlife Service (USFWS) regulations implementing the ESA's Section 7 consultation requirements define "jeopardize the continued existence" as:

> to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

50 C.F.R. § 402.02. The regulations also define the statutory term "destruction or adverse modification" of critical habitat to mean:

> a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

50 C.F.R. § 402.02. NMFS/USFWS (1996) further discusses the terms "survival" and "recovery," as they relate to analyzing jeopardy and adverse modification, as follows:

> **Survival**: the species' persistence, beyond conditions leading to its endangerment, with sufficient resilience to allow recovery. Said another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficiently large population, represented by all age classes, genetic heterogeneity, and a number of sexually mature individuals producing viable offspring, that exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter.
>
> **Recovery:** improvement in the status of a species and the ecosystems upon which they depend. Said another way, recovery is the process by which species' ecosystems are restored so they can support self-sustaining and self-regulating populations of listed species as persistent members of native biotic communities.

C. NMFS Approaches for Determining Jeopardy and Destruction/Adverse Modification of Critical Habitat

One method NMFS has used for determining the biological requirements of listed salmonids and applying them to ESA analyses is described in the document "Determination and Application of Biological Requirements in ESA Section 7(a)(2) Analyses" (NMFS 1995). This document describes a reasonable approach for determining jeopardy when sufficient population information is available and when effects of actions can be expressed relative to population levels. In the case of UR cutthroat trout, OC coho salmon, SONC coho salmon, OC steelhead, KMP steelhead, LC steelhead, chum salmon, chinook salmon, and sea-run cutthroat trout (hereafter referred to as "anadromous salmonids"), the NMFS cannot apply this method, as there is insufficient information on these populations to make the necessary population estimates.

However, NMFS has developed an alternative approach for determining jeopardy in situations where habitat modification can be determined (this is also the method used for determining destruction/adverse modification of critical habitat). This alternative approach is based on a number of assumptions (described below) regarding subpopulations of anadromous salmonids, as well as the documented relationship between habitat modification and "reproduction, numbers, and distribution" of the species. The assumptions are:

1. The anadromous life form of UR cutthroat trout is vital for the survival and recovery of the Evolutionarily Significant Unit (ESU). The final regulation listing UR cutthroat trout as endangered recognized that "[a]nadromy is considered an important component in the evolutionary legacy of *O. clarki clarki*" (August 9, 1996, 61 FR 41514). Johnson *et al*. (1994) similarly noted that "the depressed sea-run component of the population is a substantial and important component of the ESU and its loss would compromise the distinctness and viability of the inclusive ESU."

2. Abundance of the UR cutthroat trout anadromous life form in the North Umpqua River is indicated by the Winchester Dam counts. The anadromous life form is not more abundant in the South Umpqua River or in the mainstem Umpqua River (including the Smith River) than in the North Umpqua River.

3. The UR cutthroat trout ESU is comprised of multiple subpopulations (as yet undefined), each of which includes anadromous, potamodromous, and resident life forms and each of which is adapted to local subbasin or watershed environments. Preservation of the remaining genetic diversity embodied in these undefined subpopulations is essential for the survival and recovery of the ESU as a whole. This assumption is based on: 1) the variation in environmental conditions between watersheds within the Umpqua River Basin (Johnson *et al*. 1994), and 2) the high degree of genetic variation among populations of coastal cutthroat, even those in close geographic proximity.

4. UR cutthroat trout populations are below the threshold level necessary to avoid long-term loss of genetic variation. Assuming that each life form is an essential component of each subpopulation, even a low level of additional impact to any life form, especially the anadromous form which is at critically low levels, may reduce the likelihood of survival and recovery of the ESU as a whole.

5. The OC coho salmon, SONC coho salmon, OC steelhead, and KMP steelhead ESUs are comprised of multiple subpopulations (as yet undefined), each of which may be uniquely adapted to local subbasin or watershed environments. Preservation of the remaining genetic

diversity embodied in these undefined subpopulations may be essential for the survival and recovery of each population as a whole.

6. OC coho salmon abundance may be less than five percent of that in the early part of this century (July 25, 1995, 60 FR 38021). This ESU is likely to become endangered in the foreseeable future (July 25, 1995, 60 FR 38011). Hatchery fish have an extensive presence within this ESU. In this context, sustainability of natural populations is questionable.

7. All SONC coho salmon populations within this ESU are depressed relative to their past abundance, based on the limited data available (July 25, 1995, 60 FR 38011). The main stocks in this ESU (Rogue River, Klamath River, and Trinity River) are heavily influenced by hatcheries, apparently with little natural production. The apparent declines in production suggest that the natural populations are not self-sustaining.

8. The status of coho salmon stocks in most coastal streams within the SONC coho salmon ESU is not well known, but these populations are small (60 FR 38011, July 25, 1995).

9. Most OC steelhead populations have been declining in the recent past. This ESU is likely to become endangered in the foreseeable future (August 9, 1996, 61 FR 41541). Hatchery stocks may pose significant genetic introgression to this ESU.

10. Most of the KMP and LC steelhead populations within these ESUs are in significant decline, based on estimates of percent annual changes in run size (March 16, 1995, 60 FR 14253; August 9, 1996, 61 FR 41541). Declines in summer steelhead populations are of particular concern.

11. There is insufficient information to determine the status of chum salmon, chinook salmon, and sea-run cutthroat trout stocks at this time. This analysis, however, conservatively treats effects to chum salmon stocks the same as effects to the other anadromous salmonids.

Based on these assumptions, the NMFS believes that the conservation of most of these subpopulations must be ensured when conducting jeopardy or destruction/adverse modification of critical habitat analyses. While these assumptions are necessarily conservative to minimize risk to a population in the face of limited information, they will be appropriately modified when better information becomes available.

In the Stages of Analysis section below, the NMFS describes how it relates the population assumptions described above to cutthroat trout, coho salmon, steelhead, chum salmon, and chinook salmon biological habitat requirements and projected levels of habitat modification to address ESA requirements for avoiding jeopardy or destruction/adverse modification of critical habitat.

Stages of Analysis

For each conference or consultation concerning the anadromous salmonids, NMFS performs the following analysis for applying ESA standards within the framework of the above assumptions and the biological requirements described in Attachment 1 (NMFS 1996a).

The conceptual premise is that the survival and recovery of the anadromous salmonids can be assured by providing sufficient prespawning survival, egg-to-smolt survival, and upstream/downstream migration survival rates through the protection and restoration of properly functioning freshwater habitat. The NMFS has developed methods to evaluate environmental baseline conditions, together with the effects of actions, to determine whether properly functioning conditions will be present to ensure the survival and recovery of the anadromous salmonids.

1. Define the biological requirements of the listed species.

To determine whether a proposed or continuing action is likely to jeopardize a listed species or destroy or adversely modify its critical habitat, it is first necessary to define the biological requirements for ensuring the continued existence (in terms of survival and recovery) of the species. Anadromous salmonid biological requirements can be expressed in terms of environmental factors that define properly functioning freshwater habitat necessary for survival and recovery of the ESU. Individual environmental factors include water quality, habitat access, physical habitat elements, channel condition, and hydrology. Properly functioning watersheds, where all of the individual environmental factors operate together to provide healthy aquatic ecosystems, are also necessary for the survival and recovery of the anadromous salmonids. These environmental factors are known to result in sufficient prespawning survival, egg-to-smolt survival, and upstream/downstream migration survival rates to ensure survival and recovery of listed species (Reiser and Bjornn 1979, Irving and Bjornn 1984, Cuenco and McCullough 1995).

The NMFS, in collaboration with the FWS, United States Forest Service (USFS), Bureau of Land Management (BLM), has developed a method for evaluating the functional potential and current conditions of individual environmental factors and watersheds. This process is described in the document "Making ESA Determinations of Effect for Individual or Grouped Actions at the Watershed Scale" (NMFS 1996b).

This document contains a matrix of aquatic, riparian, and watershed elements ("Matrix of Pathways and Indicators") and provides generalized ranges of potential functional values (i.e., “properly functioning”, “at risk”, and “not properly functioning”) for each of the elements. NMFS acknowledges that the values provided in this generalized matrix are not appropriate for all watersheds within the ranges of anadromous salmonids. Interagency field-level teams are encouraged to adapt the general matrix as necessary to reflect local geologic and climatic influences of aquatic habitat and watershed conditions within specific physiographic areas.

2. Evaluate the relevance of the environmental baseline to the species' current status.

The environmental baseline represents a basal set of conditions to which the effects of the proposed or continuing action would be added. It "includes the past and present impacts of all Federal, State, or private activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process." See 50 C.F.R. 402.02, definition of "effects of the action."

Under this definition, the environmental baseline would not include future discretionary activities in the action area that have not undergone ESA consultation. Thus, the species' current status is described in relation to the risks presented by the continuing effects of all previous actions and resource commitments that are not subject to further exercise of Federal discretion.

For a new project, the environmental baseline represents the risks entailed by conditions in the action area that exist before the proposed actions begins. For an ongoing Federal action, it is necessary to evaluate the effects of previous resource commitments separately from the effects that would be caused by that action's proposed continuance.

The reason for determining the species' status under the risks presented by the environmental baseline (without the effects of the proposed or continuing action) is to better understand the relative significance of the action's effects upon the species' likelihood of survival and chances for recovery when those effects are added to the environmental baseline. The greater the risks the species face at the time of consultation, the more significant any additional adverse effects caused by the proposed or continuing action will be.

In addition to its use in determining the biological requirements of anadromous salmonids, "Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale" (NMFS 1996b), can also be used to characterize environmental baseline conditions. The "Matrix of Pathways and Indicators" included in the document provides a method for characterizing the environmental baseline in terms of current functional conditions of instream, riparian, and watershed elements that reflect local geologic and climactic conditions in the action area (NMFS 1996). NMFS assumes that the poorer the functional condition of these elements, the higher the risk to anadromous salmonids from additional action-related adverse effects.

3. Determine the effects of the proposed or continuing action on listed species.

In this step of the analysis, NMFS examines the likely effects of the proposed action on the species. The analysis may consider the impact in terms of how the proposed action affects anadromous salmonid habitat and/or the level of incidental take caused by the action. The analysis includes effects that may or may not be within the action agencies' discretion to correct. In addition to characterizing the environmental baseline, the "Matrix of Pathways and Indicators" (NMFS 1996b) provides a means of predicting the effect of actions on the functions and conditions of instream, riparian, and watershed elements within the action area.

4. Determine whether; a) the species can be expected to survive (with an adequate potential for recovery) under the effects of the proposed or continuing action, the environmental baseline, and any cumulative effects, and b) the action will appreciably diminish the value of critical habitat for both the survival and recovery of the species.

In this step of the analysis, NMFS determines whether the specific action under consultation is likely to jeopardize the continued existence of the listed species, or result in destruction or adverse modification of critical habitat. As described above, NMFS uses the "Matrix of Pathways and Indicators" (NMFS 1996b) to determine whether actions would further degrade the environmental baseline or hinder attainment of properly functioning aquatic conditions. Actions that do not retard attainment of properly functioning aquatic conditions when added to the environmental baseline, would not jeopardize the continued existence of anadromous salmonids or result in destruction/adverse modification of critical habitat, because they would maintain or restore the quality, distribution and abundance of habitat at the watershed scale (prespawning survival, egg-to-smolt survival, and upstream/downstream migration survival rates) thus ensuring survival and recovery of the species.

5. Identify reasonable and prudent alternatives to a proposed or continuing action that is likely to jeopardize the continued existence of the listed species, or result in destruction or adverse modification of critical habitat.

If the proposed or continuing action is likely to jeopardize the listed species or result in destruction or adverse modification of critical habitat, NMFS must suggest potential reasonable and prudent alternatives, if any, that would comply with Section 7(a)(2) of the ESA, and which can be taken by the Federal agency or applicant in implementing the agency action.

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